Poor man's nanofabrication

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The area of nanotechnology can be defined as: *The area of science and technology where dimensions in the range of 100nm play a role.* Typically, nanotechnology is performed with the help of dedicated equipment to create patterns of various shapes and materials in research and commercial areas as diverse as semiconductor electronics, scanning probe microscopy analysis, ultra filtration, data storage, photonics, protein duplication, gene therapy, and drug delivery. The most common state-of-the-art techniques to define the nanostructures are deep or extreme ultraviolet and nano imprint lithography. Both techniques make use of masks created by electron beam writing and sometimes focused ion beam techniques. Despite the importance of these techniques, they have a fundamental drawback that they are costly and typically universities can not effort to overcome this financial threshold. However, many off-the-road nanofabrication techniques have been developed having the ability for rapid prototyping orders in magnitude cheaper than the mainstream equipment. Moreover, some very useful methods have been proposed recently to improve the resolution of printing systems, not depending on the underlying printing method. For example, a new add-on technology for existing lithography – the so-called sidewall patterning technology – is able to enhance the resolution of the existing lithography by a factor of two or more without the need for new expensive equipment. Using this technique, sub-20 nm printing on top of 2 µm projection lithography has been demonstrated.

The goal of this lecture is to familiarize the listener with most of the established off-the-road techniques to create nanostructures using university-friendly equipment; the poor man's nanotechnology.